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MAGNETIC ANALYZER

MODEL MA-1040

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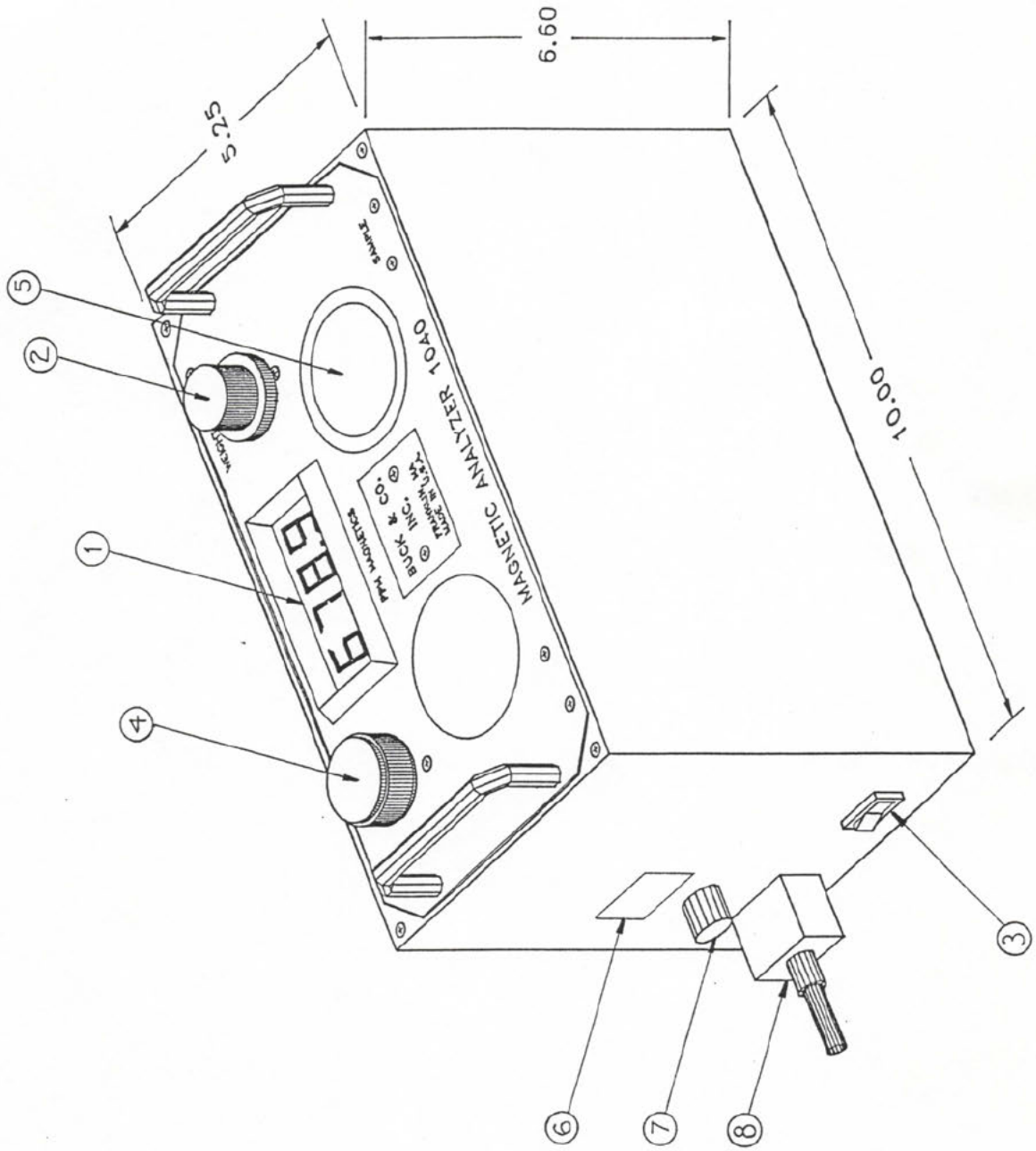
Fig. 1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MAGNETIC ANALYZER 1040
BUCK & CO.
PM1 MONITOR
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PARTS IDENTIFICATION [SEE FIG. 1]

(1) FIVE DIGIT DISPLAY - 0.7" digit Liquid Crystal type. Permissable in-range readings are 0.1 PPM to 19999.9 PPM. A = in far left digit location indicates an out of range conditon.

(2) SAMPLE WEIGHT CONTROL - Used to set the sensitivity of the instrument to compensate for samples of different weights. The net weight in grams of the sample tested is dialed in directly. Range of weights is 010 - 999 grams.

(3) POWER SWITCH - Controls the power to the instrument.

(4) NULL CONTROL - Used to give zero reading on display with no sample in sample chamber.

(5) SAMPLE CHAMBER - Port into which sample holder tube or reference standard is placed to take measurement.

(6) LABEL - Gives model number and serial number of instrument.

(7) FUSE - Buss # AGC - 1/4A or equivalent.

(8) POWER CONNECTOR - Used to connect instrument to line chord. The line voltage can be of any value between 90 volts and 250 volts, AC or DC.

OPERATING INSTRUCTIONS

1. Connect power cord to appropriate source, switch "power on" switch to "on" position, let the instrument warm up for five minutes.

2. Fill "sample holder tube" to the level of the spill hole. Obtain net weight of the sample by subtracting weight of empty "sample holder tube" from weight of full "sample holder tube". Set this weight, in grams, on the sample "weight" control dial.

3. With "sample chamber" empty (no "sample holder tube" inserted), adjust "null control" to give zero reading on display.

4. Insert filled "sample holder tube" into "sample chamber". Display will indicate relative percetage of magnetic material in the sample. The displayed magnetic value will be true for about twenty seconds, after which time the display may drift.

5. After emptying the sample tube, place the empty sample tube into the "sample chamber" and note the reading. It may be - 6.5 PPM. This value must be subtracted from the reading obtained in step 4. Since the empty sample holder reading is usually negative, the true reading is obtained by simply adding the absolute value of the empty sample holder reading to the sample reading in step 4.

6. When not in use, remove the sample holder or standard from the "sample chamber".In this condition the display should read zero.

CALIBRATION TEST

1. Connect power cord to appropriate source, switch "power on" switch to "on" position, let instrument warm up for five minutes

2. With "sample chamber" empty, set "sample weight" control to 100.0 grams and adjust the null control for zero display.

3. Place reference standard into "sample chamber". The reading should be within 1% of the value printed on the reference standard.

If the reference standard produces readings that are larger or smaller than 1% of the value printed on the standard holder, the Magnetic Analyzer should be returned for service repair or calibration to BCI.

OPERATING NOTES

In general, do not operate the instrument near strong magnetic fields, such as power lines carrying high currents. Also, do not place the instrument on a steel table. A 3/4" piece of wood (plywood) should be placed on a steel table and the instrument should be placed on top of it.

The operating environment should be of constant temperature. A changing room temperature will make the display reading drift quickly and make reading it difficult.

Always clean the sample holder carefully; do not use steel brushes to scrub it clean.

The sophisticated user may want to bias the NULL adjustment from zero to a value that would compensate for the empty sample holder reading if the sample wieght is constant. For example, the NULL can be set for a +06.5 reading instead of zero. Since the empty sample produces a reading of -06.5, the biased NULL setting will now produce a zero reading if the empty sample holder is placed into the instrument.

BACKGROUND

Before the development of the BCI Magnetic Analyzer, all of the available instruments were of low sensitivity, difficult to use and of early designs dating back to the 1940's.

Throughout the industry, particular among the abrasive grain manufacturers, a desire was expressed for an instrument with a high degree of accuracy, ease of operation and a dust tight enclosure. In 1976 the industry's desires were satisfied with the introduction of the first Model MA-1040. The design combined a digital display, presettable sample weight factor, self contained power supply, synchronous detection and an expanded measuring range down to 0.0001% of magnetics content. The most significant improvement was offered in the ease of operation and in the dust tight enclosure, combining all neccessary elements into one simple to operate test instrument.

The availability of this Model MA-1010 Magnetic Analyzer was first announced in the Abrasive Grain Assocation (AGA) special bulletin on September 23, 1976. Subsequently the American National Standards Institute (ANSI) published a bulletin on July 14, 1980 about the use of the MA-1010.

More research has been done and improvements have been made to the instrument since the development of the first unit, resulting in a new, improved Model MA-1010 A Magnetic Analyzer - a more accurate and stable unit, which is also smaller than the previous model.

The next step in the development was the Model 1010 B which featured automatic nulling and more stable readings at low percentages of magnetics. The latest magnetic analyzer model is MA 1040. It incorporates a new design with up to date electronics, single range, 0.1 parts-per-million (PPM) resolution, wide operating range and low power consumption.

CONCEPT

The Magnetic Analyzer utilizes two air-coils, one as a reference, the other as the recipient of the material sample to be measured.

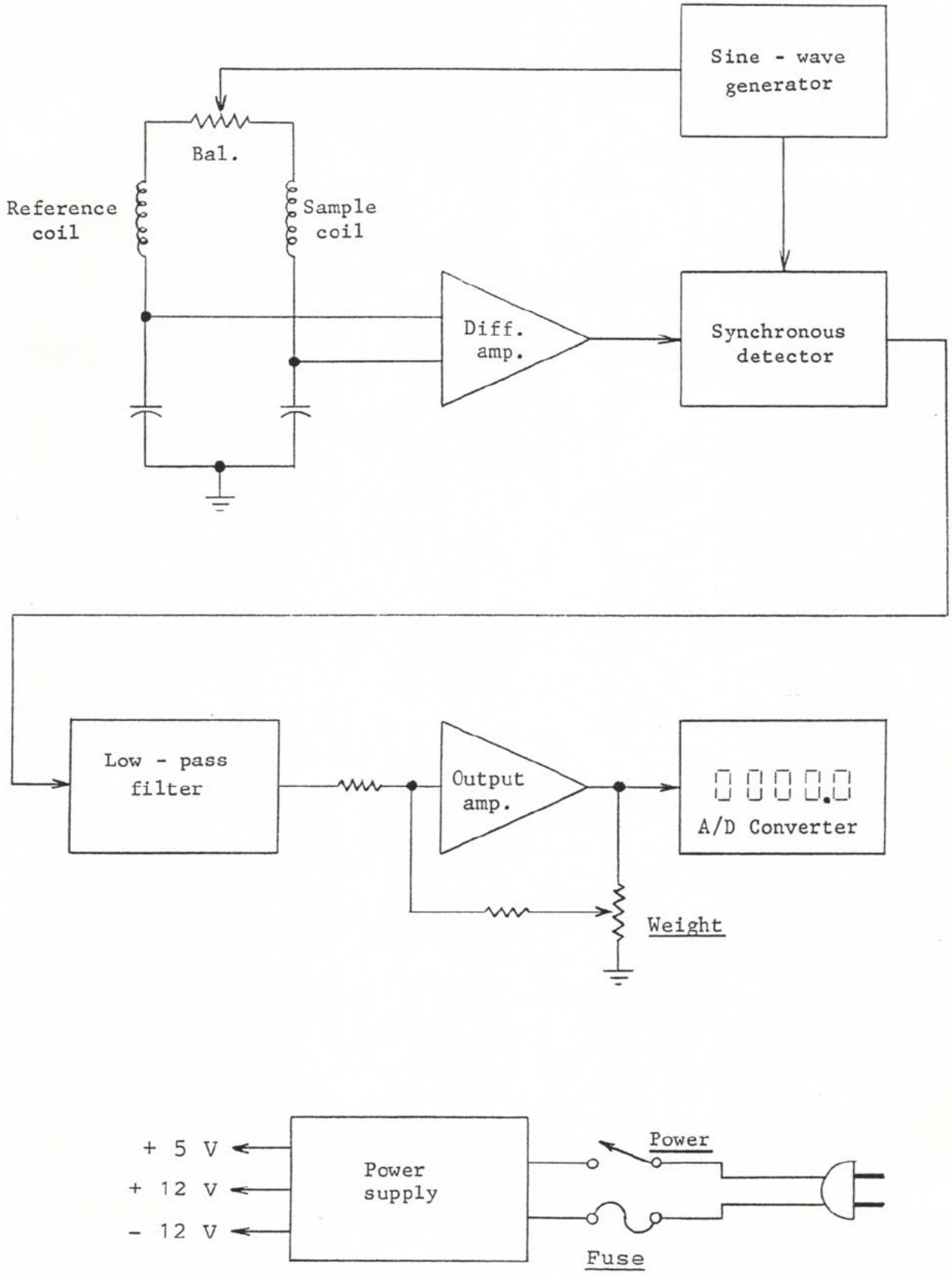
The coils are excited with an odd frequency AC source (683 Hz). This is done to reduce stray 60 Hz or 50 Hz line current magnetic pickup always present in an industrial environment. Any unbalance caused by the presence of magnetic material in the sample will produce a different signal, which will be amplified. After synchronous detection, the filtered DC signal is displayed digitally in percent of magnetics content. Gain changes and null adjustments are on the AC amplifier side, assuring accurate measurment without drift and gain changes due to temperature variations.

The new approach rejects all line frequency pick-up, because the synchronous detection method does not produce an average DC output from any frequency other than the excitation frequency. Other improvements include reduced mechanical pick-up (microphonics) and mu-metal shielding of the coils.

Model MA-1040 Magnetic Analyzer

Block Diagram.

Fig. 2



FEATURES
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* 0.1 Parts per million (PPM) or 1 PPM sensitivity and resolution.

* Single range design.

* Maximum magnetic measurement range 1999.9 PPM (or 19999.

* Automatic nulling when sample is removed.

* Sample weight range 10 grams to 999 grams.

* Four and a half digit liquid crystal display (LCD).

* Large display digit size, 0.7 inches.

* Small instrument size : 5.25 by 10 inches, 7.25 inches high.

* Durable anodized finish with silk screen lettering.

* Sealed against dust and humidity.

This is the most sensitive and stable Magnetic Analyzer built by BCI, incorporating the latest electronic circuitery. But, the proven measuring elements and sample holder used with the Model MA-1010 instruments are also used in the new MA-1040 design.

The Model MA-1040 can also be made with 1 PPM sensativity and a maximum measurement range of 2% (19,999 PPM).

There is also a serial computer interface avalable (RS-232C) for an additional cost.

THE CIRCUIT

The exitation source for the coils is a digitally devised sine wave generator with excelent amplitude frequency stability to assure indepenence of line voltage variations. Amplitude variations will affect the calibration of the instrument.

Null adjustment is accomplished by electronic means when no sample is in the coils.

The difference voltage generated by the two coil current is amplified by an AC pre-amplifier. A weight calibration control is provided which adjusts the gain of the amplifier.

After amplification the AC difference signal is demodulated (rectified in a synchronous manner). Together with the following active filter, this rectifier produces an average DC output only for the synchronous frequency of 683 Hz, while rejecting all other frequencies.

A digital voltmeter is used to display the measured magnetic properties in percent of magnetics content.

The MA-1040 Magnetic Analyzer has an active electronic circuit that nulls the display automatically when there is no sample holder or reference standard in the SAMPLE opening. The null value is adjustable by the NULL control. The range of adjustment is approximately -20 to +20.

The presence of a sample holder or reference standard is sensed by a photo cell located in the black spacer at the SAMPLE opening. An invisable light beam (infra-red light) is shining across the SAMPLE opening into the photo detector. Interrupting the light beam stops the instrument from automatic nulling and allows the true magnetic value to be displayed.

THE PACKAGE

All of the Magnetic Analyzer components are housed in a small aluminum, dust tight consolet designed to house electrical controls and instruments.

The top of the instrument serves as a control panel function. The sample is lowered into a hole provided in the panel and a digital, direct direct reading display of 0.7 inch character height shows the results. All controls, are located on the control panel exept for the power-on switch, which is on the left side panel. A line fuse is provided to protect the instrument from damage in case of internal short.

REFERENCE STANDARD

Certified Magnetic reference standards are available from the Abrasive Grain Association (AGA), 712 Lakewood Center North, Cleveland, OH 44107. The reference standards can be purchased from the AGA outright, or the BCI reference standard supplied with the Magnetic Analyzer can be shipped to AGA for verification. The AGA will check the BCI reference standard against the AGA Master Magnetic Analyzer and it's world standard.

The American National Standards Institute, Inc. (ANSI), has announced that a revised version of the ANSI B74.19-1980 publication will be available sometime in 1990. This new bulletin will have reference to the availability of AGA certified magnetic standards for the instrument calibration, from the AGA office.

WARRANTY

The manufacturer guaranties that the instrument will be in operating condition and performing according to specifications at time of shipping. The manufacturer further warrants repair and service of the instrument for one year after delivery, provided the instrument is returned to the manufacturer. It will be the decision of the manufacturer to warrant free service subject to conditions that the instrument was not tampered with, abused, or damaged in shipment.